

## Drosos Koutsoubas & Athanasios Koukouras (\*)

### AN ACCOUNT OF OUR KNOWLEDGE ON THE OPISTHOBRANCH MOLLUSC FAUNA OF THE AEGEAN SEA (\*\*)

KEY WORDS: Mollusca, Gastropoda, Opisthobranchia, Zoogeography, Aegean Sea.

#### Riassunto

Viene esposto per la prima volta un elenco ragionato della fauna a molluschi opistobranchi del Mare Egeo. 23 specie sono nuove per la malacofauna di questo mare. Fra quest'ultime, 7 non erano conosciute nel Mediterraneo Orientale. Infine è anche discussa la composizione ed il significato biogeografico della malacofauna degli opistobranchi del Mare Egeo.

#### Abstract

A check list of the opisthobranch molluscs of the Aegean Sea is presented for the first time. 23 species are new records for the mollusc fauna of the Aegean Sea. Among the latter 7 species were not previously known in the Eastern Mediterranean. The systematic composition and zoogeographical status of the opisthobranch mollusc fauna of the Aegean Sea is also discussed.

#### Introduction

Our knowledge on the Aegean opisthobranch mollusc fauna is rather limited compared with that of other Mediterranean areas. Information about the opisthobranch mollusc fauna in the Aegean Sea is included in a restricted number of papers (DESHAYES, 1835; FORBES, 1844 critically revised by NORDSIECK, 1977; JEFFREYS, 1883; CARUS, 1893; STURANY, 1896; PRUVOT-FOL & FISCHER-PIETTE, 1934; PRUVOT-FOL, 1954; OBERLING, 1960-1962; SALVINI-PLAWEN & STERRER, 1968; GHISOTTI, 1968/78; RAMPAL, 1970; NORDSIEK, 1972; WAWRA, 1974; THOMPSON, 1983, 1985, 1988; THOMPSON & TURNER, 1983; THOMPSON & BROWN, 1984; WÄGELE, 1985; BARASH & DANIN, 1986; THOMPSON & JAKLIN, 1988; TENEKIDIS, 1989; THOMPSON *et al.*, 1990; KOUTSOUBAS *et al.*, 1992, 1993). Some other papers of mainly ecological interest (PÉRÈS & PICARD, 1958; LABOREL, 1960; JACQUOTTE, 1962; LEDOYER, 1966, 1969; KIORTSIS, 1969; GELDIAY & KOCATAS, 1972; FIELDING & EDMUND, 1973; BIANCHI & MORRI, 1983; KOUKOURAS *et al.* 1985; THOMPSON *et al.*, 1985) give also scattered information on the opisthobranch molluscs of the Aegean Sea.

(\*) Department of Zoology, University of Thessaloniki, 54006 Thessaloniki, Greece.

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According to the information given by the above mentioned authors a total of 114 opisthobranch species is known from the Aegean Sea.

In 1986, a research program on the qualitative composition of the benthic fauna of the North Aegean Sea started. Samplings carried out in that period, in various habitats and depths revealed an important number of opisthobranch species.

The main goal of this study is: (i) to present for the first time an updated check-list of Aegean opisthobranch species, (ii) to give additional information on the opisthobranch mollusc fauna of the Aegean Sea and (iii) to discuss the systematic composition and zoogeographical status of this fauna.

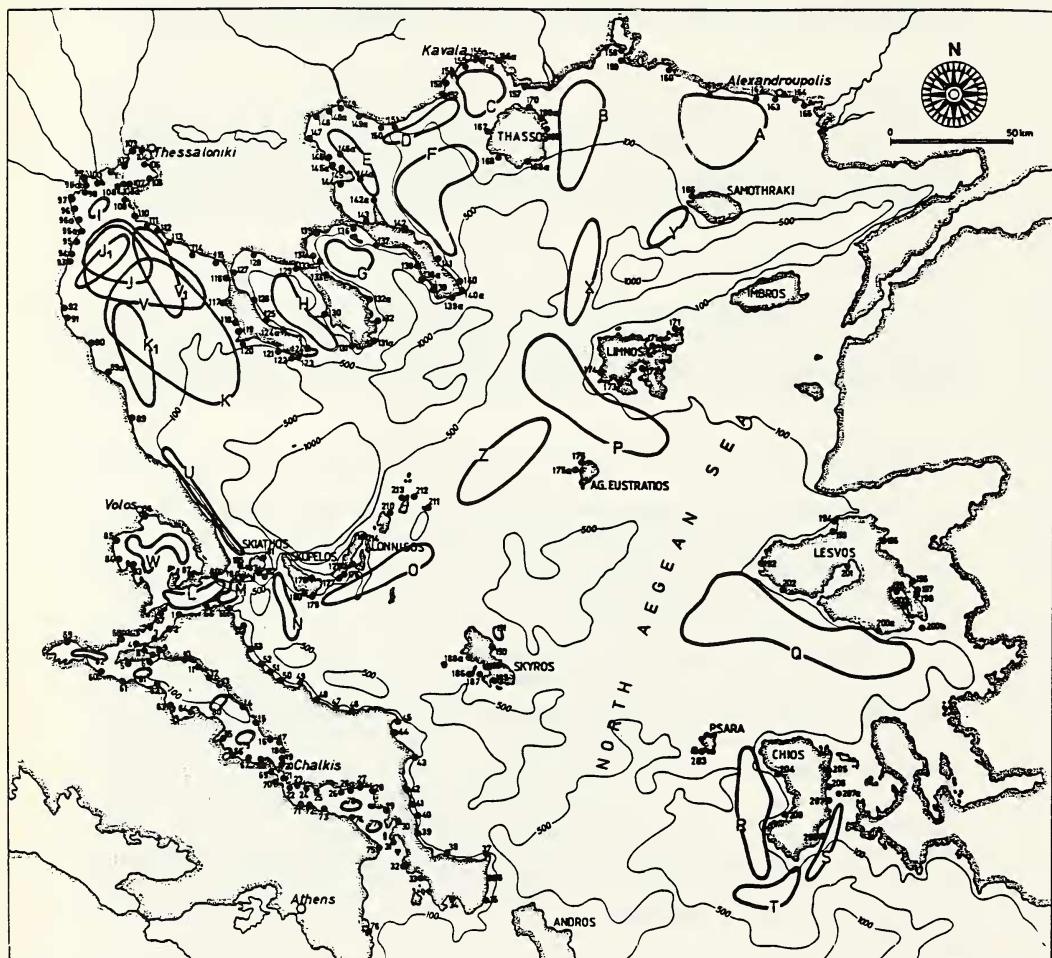


Fig. 1. Map of the North Aegean Sea indicating the sampling stations. (●: sampling stations where the samples were collected by SCUBA diving or grab; —: sampling stations where the samples were collected by dredge or fishing nets).

Table I. Opisthobranch mollusc species known from the Aegean Sea (A=authors' collection; the authors given in brackets were the first to report the presence of the species in the Aegean Sea; \* first record for the North Aegean Sea; \*\* first record for the Aegean Sea; \*\*\* first record for the Eastern Mediterranean).

### Order CEPHALASPIDEA

#### Family Acteonidae

- Acteon tornatilis* (Linnaeus, 1758) [DESHAYES, 1835; A]
- \*\*\* *Acteon monterosatoi* Dauntzenberg, 1889 [A]
- \* *Crenilabium exile* (Forbes in Jeffreys, 1870) [CARUS, 1893; A]
- \* *Liocarenus globulinus* (Forbes, 1844) [FORBES, 1844; A]
- Japonacteon pusillus (Forbes, 1844) [FORBES, 1844; A]

#### Family Diaphanidae

- *Diaphana cretica* (Forbes, 1844) [FORBES, 1844]

#### Family Retusidae

- Retusa leptoneilema* (Brusina, 1866) [CARUS, 1893]
- Retusa mammillata* (Philippi, 1836) [FORBES, 1844]
- \* *Retusa obtusa* (Montagnu, 1803) [OBERLING, 1960-62; A]
- \* *Retusa semisulcata* (Philippi, 1836) [FORBES, 1844; A]
- Retusa truncatula* (Bruguere, 1792) [FORBES, 1844; A]
- Retusa piriformis* (Monterosato, 1878) [NORDSIECK, 1972]
- \* *Cyllichnina umbilicata* (Montagu, 1803) [OBERLING, 1960-62; A]
- \* *Volvulella acuminata* (Bruguere, 1792) [KOUTSOUBAS *et al.*, 1992; A]

#### Family Ringiculidae

- Ringicula auriculata* (Menard de la Groye, 1811) [FORBES, 1844; A]
- \* *Ringicula conformis* (Monterosato, 1877) [TENEKIDIS, 1989; A]
- \*\* *Ringicula leptocheila* Brugnone, 1873 [A]

#### Family Bullidae

- Bulla striata* Bruguere, 1792 [FORBES, 1844; A]

#### Family Haminaeidae

- Haminaea hydatis* (Linnaeus, 1758) [FORBES, 1844; A]
- Haminaea navicula* (Da Costa, 1778) [FORBES, 1844; A]
- Atys brocchi* (Michelotti, 1847) [TENEKIDIS, 1989]
- \* *Atys jeffreysi* (Weinkauff, 1868) [JACQUOTTE, 1962]
- \* *Weinkauffia turgidula* (Forbes, 1844) [FORBES, 1844; A]

#### Family Philinidae

- Philine aperta* (Linnaeus, 1767) [DESHAYES, 1835; A]
- Philine catena* (Montagu, 1803) [FORBES, 1844; A]
- Philine punctata* (Adams J., 1800) [FORBES, 1844]
- Johania retifera* (Forbes, 1844) [FORBES, 1844]

#### Family Aglajidae

- Phelinopsis depicta* (Renier, 1804) [LEDOYER, 1966]

#### Family Akeridae

- \* *Akera bullata* Mueller O.F., 1776 [FORBES, 1844; A]

#### Family Cylchinidae

- Cylchna alba* (Brown, 1827) [TENEKIDIS, 1989]
- Cylchina crossei* B.D.D., 1886 [TENEKIDIS, 1989]
- \* *Cylchna cylindracea* (Pennant, 1777) [FORBES, 1844; A]
- Cylchna parvula* Jeffreys, 1883 [JEFFREYS, 1883]
- Roxania utriculus* (Brocchi, 1814) [FORBES, 1844; A]
- \*\*\* *Roxania monterosatoi* Dautzenberg & Fischer, 1986 [A]
- Scaphander lignarius* (Linnaeus, 1758) [FORBES, 1844; A]

Family <b>Gastropteridae</b>		
* <i>Gastropteron meckeli</i> Kosse, 1813	[FORBES, 1844; A]	
Family <b>Philinoglossidae</b>		
<i>Philinoglossa helgolandica</i> Hertling, 1932	[WAWRA, 1974]	
Order THECOSOMATA		
Family <b>Cavolinidae</b>		
<i>Cavolinia gibbosa</i> (D'Orbigny, 1835 ex Rang ms)	[FORBES, 1844; A]	
<i>Cavolinia inflexa</i> (Lesueur, 1813)	[FORBES, 1844; A]	
<i>Cavolinia tridentata</i> (Niebuhr, 1775 ex Forskal ms)	[FORBES, 1844; A]	
<i>Diacria trispinosa</i> (Lesueur, 1821)	[RAMPAL, 1970]	
<i>Clio cuspidata</i> (Bosc, 1802)	[FORBES, 1844; A]	
<i>Clio pyramidata</i> Linnaeus, 1767	[FORBES, 1844; A]	
<i>Creseis acicula</i> Rang. 1828	[FORBES, 1844; A]	
<i>Creseis virgula</i> Rang, 1828	[KIORTSIS 1969; A]	
<i>Hyalocylis striata</i> (Rang, 1828)	[FORBES, 1844; A]	
<i>Styliola subula</i> (Quoy & Gaimard, 1827)	[FORBES, 1844]	
Family <b>Limacinidae</b>		
<i>Limacina retroversa</i> (Fleming, 1823)	[GHISOTTI, 1968/78]	
<i>Limacina bulimoidea</i> (D'Orbigny, 1836)	[CARUS, 1893]	
* <i>Limacina trochiformis</i> (D'Orbigny, 1836)	[JEFFREYS, 1883; A]	
<i>Limacina inflata</i> (D'Orbigny, 1836)	[JEFFREYS, 1883; A]	
<i>Limacina helicoides</i> Jeffreys, 1877	[KIORTSIS, 1969]	
Family <b>Cymbuliidae</b>		
<i>Cymbulia peronii</i> Lamarck, 1819	[KIORTSIS, 1969; A]	
Family <b>Peraclidae</b>		
<i>Peracle reticulata</i> (D'Orbigny, 1836)	[FORBES, 1844]	
<i>Peracle bispinosa</i> Pelseneer, 1888	[KIORTSIS, 1969]	
<i>Peracle triacantha</i> (Fischer P., 1882)	[KIORTSIS, 1969]	
Order SACOGLOSSA		
Family <b>Oxynoidae</b>		
<i>Oxynoe olivacea</i> Rafinesque, 1814	[FORBES, 1844]	
<i>Lobiger serratifalci</i> (Calcara, 1840)	[TENEKIDIS, 1989]	
Family <b>Volvatellidae</b>		
* <i>Ascobulla fragilis</i> (Jeffreys, 1856)	[TENEKIDIS, 1989; A]	
Family <b>Elysiidae</b>		
<i>Elysia flava</i> Verrell, 1901	[THOMPSON, 1983]	
<i>Elysia timida</i> (Risso, 1818)	[FORBES, 1844]	
<i>Elysia translucens</i> Pruvot-Fol, 1957	[THOMPSON & JAKLIN, 1988]	
<i>Elysia viridis</i> (Montagu, 1804)	[LEDOYER, 1969]	
<i>Thuridilla hopei</i> (Vérany, 1853)	[THOMPSON & JAKLIN, 1988]	
Family <b>Boselidae</b>		
<i>Bosellia mimetica</i> Trinchese, 1891	[THOMPSON & JAKLIN, 1988]	
Family <b>Polybranchiidae</b>		
<i>Polybranchia bognini</i> (Trinchese, 1896)	[THOMPSON, 1988]	
<i>Aplysiopsis elegans</i> Deshayes, 1864	[KOUTSOUBAS <i>et al.</i> , 1993; A]	
<i>Cyerce graeca</i> Thompson T.E., 1988	[THOMPSON, 1988]	
Family <b>Stiligeridae</b>		
<i>Placida saronica</i> (Thompson T.E., 1988)	[THOMPSON, 1988]	

## Order NOTASPIDEA

### Family Umbraculidae

\* *Umbraculum umbraculum* (Roeding, 1798) [FORBES, 1844; A]

### Family Tylolinidae

*Tylodina perversa* (Gmelin, 1791)

[PRUVOT-FOL & FISCHER-PIETTE, 1934; A]

### Family Pleurobranchidae

\*\* *Pleurobranchus membranaceus* (Montagu, 1815)

[A]

*Berthella aurantiaca* (Risso, 1818)

[FORBES, 1844]

*Berthella plumula* (Montagu, 1803)

[TENEKIDIS, 1989]

*Berthella stellata* (Risso, 1826)

[THOMPSON, 1985; A]

\*\* *Pleurobranchaea meckelii* Meckel in Leue, 1813

[A]

## Order ACOCHLIDIACEA

### Family Hedylopsidae

*Hedylopsis spiculifera* (Kowalewsky, 1901)

[PRUVOT-FOL., 1954]

### Family Microhedylidae

*Microhedyle glandulifera* (Kowalewsky, 1901)

[WAWRA, 1974]

*Pontochedyle milatschewitchi* (Kowalewsky, 1901)

[WAWRA, 1974]

## Order ANASPIDEA

### Family Aplysiidae

\*\* *Aplysia depilans* Gmelin, 1791

[A]

\*\* *Aplysia parvula* Guilding in Moerch, 1863

[A]

*Aplysia punctata* (Cuvier, 1803)

[PERES & PICARD, 1958; A]

*Aplysia fasciata* Poiret, 1789

[FIELDING & EDMUNDS, 1973; A]

*Bursatella leachii* Blainville, 1817

[BARASH & DANIN, 1986; A]

### Family Dolabriferidae

*Notarchus punctatus* Philippi, 1836

[FORBES, 1844]

*Petalifera petalifera* (Rang, 1828)

[THOMPSON *et al.*, 1985]

*Phyllaplysia lafonti* (Fischer P., 1870)

[FORBES, 1844]

## Order NUDIBRANCHIA

### Family Aegiridae

*Aegires punctilucens* (D'Orbigny, 1837)

[LEDOYER, 1966]

### Family Gonoiodorididae

*Okenia elegans* (Leuckart, 1828)

[KOUTSOUVAS *et al.*, 1993; A]

### Family Dorididae

*Doris marmorata* Risso, 1818

[KOUTSOUVAS *et al.*, 1993; A]

\*\* *Doris ocelligera* (Bergh, 1881)

[A]

### Family Archidorididae

*Archidoris pseudoargus* (Rapp, 1827)

[KOUTSOUVAS *et al.*, 1993; A]

### Family Chromodorididae

\*\* *Chromodoris krobni* (Vérany, 1846)

[A]

*Chromodoris luteorosea* (Rapp, 1827)

[KOUTSOUVAS *et al.*, 1993; A]

\*\* *Chromodoris purpurea* (Risso in Guérin, 1831)

[A]

\*\*\* *Hypselodoris messinensis* (Von Ihering, 1880)

[A]

\*\*\* *Hypselodoris tricolor* (Cantraine, 1835)

[A]

\* *Hypselodoris villafranca* (Risso, 1818)

[FORBES, 1844; A]

\* *Hypselodoris webbi* (D'Orbigny, 1839)

[THOMPSON & TURNER, 1983; A]

<b>Family Discodorididae</b>		
** <i>Discodoris atromaculata</i> (Bergh, 1880)	[LABORET, 1960; A]	
** <i>Paradoris indecora</i> (Bergh, 1881)	[A]	
*** <i>Thordisa filix</i> Pruvot-Fol., 1951	[A]	
<b>Family Kentrodorididae</b>		
<i>Jorunna tomentosa</i> (Cuvier, 1804)	[KOUTSOUVAS <i>et al.</i> , 1993; A]	
<b>Family Platydorididae</b>		
* <i>Platydoris argo</i> (Linnaeus, 1767)	[FORBES, 1844; A]	
** <i>Baptodoris cinnabrina</i> Bergh, 1884	[A]	
** <i>Taringa armata</i> Swennen, 1961	[A]	
<b>Family Rostangidae</b>		
* <i>Rostanga rubra</i> (Risso, 1818)	[FORBES, 1844; A]	
<b>Family Polyceridae</b>		
<i>Polycera quadrilineata</i> (Mueller, O.F., 1776)	[LEDOYER, 1966]	
*** <i>Limacia clavigera</i> (Mueller O.F., 1776)	[A]	
<b>Family Dendrodorididae</b>		
** <i>Dendrodoris grandiflora</i> (Rapp. 1827)	[A]	
<i>Dendrodoris limbata</i> (Cuvier, 1804)	[KOUKOURAS <i>et al.</i> , 1985; A]	
<b>Family Phyllidiidae</b>		
<i>Phyllidia flava</i> Aradas, 1847	[WÄGELE, 1985; A]	
<b>Family Dotidae</b>		
<i>Doto coronata</i> (Gmelin, 1791)	[FORBES, 1844]	
<i>Doto fragilis</i> (Forbes, 1838)	[FORBES, 1844]	
<i>Doto floridicola</i> Simroth, 1888	[THOMPSON <i>et al.</i> , 1990]	
<i>Doto pontica</i> Swennen, 1961	[THOMPSON <i>et al.</i> , 1990]	
<i>Doto lemchei</i> Ortea & Urgorri, 1989	[THOMPSON <i>et al.</i> , 1990]	
<i>Doto rosea</i> Trinchese, 1881	[THOMPSON <i>et al.</i> , 1990]	
<b>Family Hancockiidae</b>		
<i>Hancockia uncinata</i> (Hesse, 1872)	[LEDOYER, 1966]	
<b>Family Scyllaeidae</b>		
<i>Scyllaea pelagica</i> Linnaeus, 1758	[FORBES, 1844]	
<b>Family Tethyidae</b>		
<i>Tethys fimbria</i> Linnaeus, 1767	[FORBES, 1844; A]	
<b>Family Tritoniidae</b>		
** <i>Tritonia manicata</i> Deshayes, 1853	[A]	
<i>Tritonia plebeia</i> Johnston, 1828	[FORBES, 1844]	
** <i>Marionia blainvillea</i> (Risso, 1818)	[A]	
** <i>Marionia tethydea</i> (Delle Chiaje, 1822)	[A]	
<b>Family Arminidae</b>		
<i>Armina maculata</i> Rafinesque, 1814	[THOMPSON <i>et al.</i> , 1990; A]	
<i>Armina neapolitana</i> (Delle Chiaje, 1824)	[KOUTSOUVAS <i>et al.</i> , 1993; A]	
<b>Damly Aeolidiidae</b>		
<i>Aeolidiella alderi</i> (Cocks, 1852)	[THOMPSON & BROWN, 1984; A]	
<b>Family Facelinidae</b>		
** <i>Facelina rubrovittata</i> (Costa A., 1886)	[A]	
<i>Cratena peregrina</i> (Gmelin, 1791)	[KOUTSOUVAS <i>et al.</i> , 1993; A]	

<b>Family Flabellinidae</b>			
* <i>Flabellina affinis</i> (Gmelin, 1791)		[BIANCHI & MORRI, 1983; A]	
*** <i>Coryphella pedata</i> (Montagu, 1815)		[A]	
<b>Family Pseudovermidae</b>			
<i>Pseudovermis boedeni</i> Salvini-Plawen & Sterrer, 1968		[WAWRA, 1974]	
<i>Pseudovermis kowalewskyi</i> Salvini-Plawen & Sterrer, 1968		[SALVINI-PLAWEN & STERRER, 1968]	
<i>Pseudovermis papillifer</i> Kowalewsky, 1901		[SALVINI-PLAWEN & STERRER, 1968]	
<b>Family Tergipedidae</b>			
<i>Cuthona caerulea</i> (Montagu, 1804)		[LEDOYER, 1966]	

Table II. Systematic composition of the opisthobranch mollusc fauna from the Aegean Sea.

Order	Family	Genus	Species
Cephalaspidea	12	22	38 (27.74%)
Thecosomata	4	9	19 (13.87%)
Gymnosomata	0	0	0 ( 0.00%)
Saccoglossa	6	10	13 ( 9.49%)
Notaspidea	3	5	7 ( 5.11%)
Acochlidiaeae	2	3	3 ( 2.19%)
Anaspidea	2	5	8 ( 5.84%)
Nudibranchia	23	32	49 (35.76%)
Total	52	86	137

Table III. Number of Aegean opisthobranch molluscs in different zoogeographic categories (137 species).

Atlanta-Mediterranean	47 (34.30%)
Boreal	30 (21.90%)
Mediterranean endemics	29 (21.17%)
Cosmopolitan	18 (13.14%)
Subtropical	7 ( 5.11%)
Circumtropical	6 ( 4.38%)
Total	137

## Materials and Methods

Specimens were collected by SCUBA diving and dredge, grab or fishing nets from 87 sampling stations in various areas of the North Aegean Sea (fig. 1) at depths from 0 to 1000 m. Specimens were preserved in 5% formalin and are deposited in the Museum of the Department of Zoology, University of Thessaloniki. The classification used is that proposed by SABELLI *et al.* (1990).

## **Results and Discussion**

The examination of the collected material (930 live individuals and shells) from the North Aegean Sea revealed the presence of 82 opisthobranch species. 7 of these species are new records for the fauna of the eastern basin of the Mediterranean (eastern of 20°), 16 are new for the fauna of the Aegean Sea and 18 are reported for the first time from the North Aegean Sea.

Besides the 82 opisthobranch species found during this study in the Aegean Sea, 55 more species reported by other authors should be considered. Thus, the total number of the opisthobranch molluscs known from the Aegean Sea, known up to now are given in Table I with the relevant literature sources. In this Table, 10 species reported by FORBES (1844) from various localities of the Aegean Sea are not included, either because their systematic identity is doubtful (*Pleurobranchus calyptraoides* Forbes, 1844; *Pleurobranchus limacoides* Forbes, 1844; *Pleurobranchus scutatus* Forbes, 1844; *Pleurobranchus sordidus* Forbes, 1844; *Goniodoris regalis* Forbes, 1844; *Goniodoris tenerima* Forbes, 1844; *Goniodoris vivida* Forbes, 1844; *Doris aurata* Forbes, 1844) or because their presence in the Mediterranean Sea has not been confirmed (*Acanthodoris pilosa* (Abildgaard in Mueller, 1789); *Coryphella verrucosa* (Sars M., 1829)).

The systematic composition of the Aegean opisthobranch mollusc fauna is presented in Table II. Nudibranchia are represented by the greatest number of species followed by Cephalaspidea.

It has already been mentioned by CATTANEO-VIETTI & THOMPSON (1989) that there are insufficient data on the zoogeography of the opisthobranchs in the different areas of the Mediterranean Sea. Zoogeographic analyses on the opistobranch mollusc fauna of the Aegean Sea (Table III) revealed that the largest opisthobranch category is the Atlanto-Mediterranean (55 species, 39.86%) followed by Boreal (31 species, 22.46%) and Mediterranean endemics (27 species, 19.56%). It is worth mentioning the absence of Indo-Pacific opisthobranch species from the Aegean, despite the vicinity of this sea to the Levantine basin from where an important number of Indo-Pacific opisthobranch species has been reported (BARASCH & DANIN, 1972, 1986; POR, 1978).

The review of the relevant literature and the results of the present study show that the total number of opisthobranch species in the Aegean Sea is greater than that known from other areas of the Eastern Mediterranean, but it is still lower than that known from certain areas of the Western Mediterranean. However, we believe that the great numerical difference between the opisthobranch species known from the Aegean Sea and those from areas of the Western Mediterranean, will be significantly reduced, when the research in the Aegean becomes more intensive.

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